

**WHAT IS CLAIMED IS:**

1. A method of estimating interference in a terminal in a code division multiple access communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code,

5 comprising the steps of:

    determining an empty channelization code *m* under the alternative scrambling code;

    if an empty channelization code *m* is determined, using the empty channelization code *m* for estimating the interference; and

    otherwise, estimating the interference by determining a variance of symbols in at least

10 one portion of the dedicated channel.

2. The method of claim 1, wherein the variance of symbols is determined by determining whether the communication system is using discontinuous transmission (DTX), and if DTX is not used, estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel.

15 3. The method of claim 2, wherein the at least two portions include a dedicated physical control channel (DPCCH) and a dedicated physical data channel (DPDCH).

4. The method of claim 1, wherein the dedicated channel is a dedicated physical channel (DPCH) and the pilot channel is a common pilot channel (CPICH).

20 5. The method of claim 1, wherein the empty channelization code *m* is determined based on either information of such an empty code or identification of the empty code.

6. The method of claim 5, wherein the information of the empty channelization code *m* is included in a message sent to the terminal.

7. The method of claim 5, wherein the information of an empty channelization code *m* is included in a specification of the communication system.

25 8. The method of claim 7, wherein the information of an empty channelization code includes channelization codes used by a common control channel.

9. The method of claim 5, wherein identification of the empty channelization code *m* comprises the steps of:

    generating an initial *I*-estimate;

30     setting a threshold based on the initial *I*-estimate;

    selecting a candidate empty channelization code;

    for the candidate empty channelization code, forming an *I*-estimate;

    comparing the formed *I*-estimate to the threshold; and

if the formed I-estimate exceeds the threshold, selecting another candidate empty code and repeating the forming and comparing steps, otherwise identifying the candidate empty code as the empty channelization code.

10. The method of claim 9, wherein the initial I-estimate is based on a variance of  
5 symbols in a signal received by the terminal.

11. The method of claim 9, wherein the threshold is set as the initial I-estimate.

12. The method of claim 9, wherein the I-estimate is formed according to

$$I_m = \frac{1}{N} \sum_{k=1}^N |d_k^m|^2.$$

13. The method of claim 1, wherein the interference for an empty channelization code m  
10 is estimated according to  $I_m = \frac{1}{N} \sum_{k=1}^N |d_k^m|^2$ .

14. The method of claim 1, wherein if an empty channelization code is not determined, the interference is estimated by determining a variance of symbols according to

$$\hat{I}_{\text{DPCH}} = \frac{1}{N} \sum_{k=1}^N |a_d(k) - m_d|^2.$$

15 The method of claim 1, wherein a portion is a dedicated physical control channel (DPCH).

16. The method of claim 1, wherein the estimated interference is used for estimating a signal-to-interference ratio.

17. A method of searching for an empty channelization code m in a terminal in a code division multiple access communication system, comprising the steps of:

20 generating an initial I-estimate;

setting a threshold based on the initial I-estimate;

selecting a candidate empty channelization code m;

for the candidate empty channelization code m, forming an I-estimate;

comparing the formed I-estimate to the threshold; and

25 if the formed I-estimate exceeds the threshold, selecting another candidate empty channelization code and repeating the forming and comparing steps, otherwise identifying the candidate empty channelization code m as an empty channelization code.

18. The method of claim 17, wherein the initial I-estimate is based on a variance of symbols in a signal received by the terminal.

30 19. The method of claim 17, wherein the threshold is set as the initial I-estimate.

20. The method of claim 17, wherein the I-estimate is formed according to

$$I_m = \frac{1}{N} \sum_{k=1}^N |d_k^m|^2.$$

21. The method of claim 17, further comprising the step of estimating interference based on the empty channelization code.

5        22. The method of claim 17, wherein a threshold is derived from the initial I-estimate by filtering the initial I-estimate.

23. The method of claim 17, wherein the candidate empty channelization code m is selected based on predetermined code allocation rules.

10       24. The method of claim 17, wherein the candidate empty channelization code m is selected by determining a channelization code used by a channel, locating the used channelization code in a code tree, and choosing as the candidate empty channelization code m a code in the code tree that is remote from the used channelization code.

15       25. An apparatus for estimating interference in a terminal in a code division multiple access communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code, comprising:

        a controller that determines an empty channelization code m under the alternative scrambling code; and

20        an interference estimator, wherein if the controller determines an empty channelization code m, the interference estimator generates an estimate of the interference based on the empty channelization code m; otherwise, the interference estimator generates the estimate of the interference based on a variance of symbols in at least one portion of the dedicated channel.

25       26. The apparatus of claim 25, wherein the controller determines whether the communication system is using discontinuous transmission (DTX), and if DTX is not used, the interference estimator generates the estimate of the interference based on a variance of symbols in at least two portions of the dedicated channel.

27. The apparatus of claim 25, wherein the controller determines the empty channelization code m based on either information of such an empty code or identification of the empty code, and controller identifies the empty channelization code m by:

30        generating an initial I-estimate;  
        setting a threshold based on the initial I-estimate;  
        selecting a candidate empty channelization code;  
        for the candidate empty channelization code, forming an I-estimate;

comparing the formed I-estimate to the threshold; and

if the formed I-estimate exceeds the threshold, selecting another candidate empty code and repeating the forming and comparing steps, otherwise identifying the candidate empty code as the empty channelization code.

5           28. The apparatus of claim 27, wherein the threshold is derived from the initial I-estimate by filtering the initial I-estimate.

29. The apparatus of claim 25, wherein the terminal complies with a standard for a universal mobile telecommunications system.

10           30. A computer-readable medium containing a computer program for estimating interference in a terminal in a code division multiple access communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code, wherein the computer program performs the steps of:

determining an empty channelization code m under the alternative scrambling code;

15           if an empty channelization code m is determined, using the empty channelization code m for estimating the interference; and

otherwise, estimating the interference by determining a variance of symbols in at least one portion of the dedicated channel.

20           31. The computer-readable medium of claim 30, wherein the computer program determines the variance of symbols by determining whether the communication system is using discontinuous transmission (DTX), and if DTX is not used, the computer program estimates the interference by determining a variance of symbols in at least two portions of the dedicated channel.

25           32. The computer-readable medium of claim 30, wherein the computer program determines the empty channelization code m based on either information of such an empty code or identification of the empty code, and the computer program identifies the empty channelization code m by performing the steps of:

generating an initial I-estimate;

setting a threshold based on the initial I-estimate;

30           selecting a candidate empty channelization code;

for the candidate empty channelization code, forming an I-estimate;

comparing the formed I-estimate to the threshold; and

if the formed I-estimate exceeds the threshold, selecting another candidate empty code and repeating the forming and comparing steps, otherwise identifying the candidate empty code as the empty channelization code.